DECISION ANALYSIS:

CLINICAL ART OR CLINICAL SCIENCE?

DECISION RESEARCH • A BRANCH OF PERCEPTRONICS

Baruch Fischhoff

12

B. S.

ADVANCED DECISION TECHNOLOGY PROGRAM

CYBERNETICS TECHNOLOGY OFFICE
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Office of Naval Research • Engineering Psychology Programs

The objective of the Advanced Decision Technology Program is to develop and transfer to users in the Department of Defense advanced management technologies for decision making. These technologies are based upon research in the areas of decision analysis, the behavioral sciences and interactive computer graphics. The program is sponsored by the Cybernetics Technology Office of the Defense Advanced Research Projects Agency and technical progress is monitored by the Office of Naval Research – Engineering Psychology Programs. Participants in the program are:

Decisions and Designs, Incorporated
Harvard University
Perceptronics, Incorporated
Stanford University
The University of Southern California

Inquiries and comments with regard to this report should be addressed to:

Dr. Martin A. Tolcott
Director, Engineering Psychology Programs
Office of Naval Research
800 North Quincy Street
Arlington, Virginia 22217

or

LT COL Roy M. Gulick, USMC
Cybernetics Technology Office
Defense Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, Virginia 22209

TECHNICAL REPORT PTR-1042-77-5

DECISION ANALYSIS:

CLINICAL ART OR CLINICAL SCIENCE?

by

Baruch Fischhoff

Sponsored by

Defense Advanced Research Projects Agency
ARPA Order No. 3052

Under Subcontract from
Decisions and Designs, Incorporated
McLean, Va

May 1977

DECISION RESEARCH
A BRANCH OF PERCEPTRONICS
1201 Oak Street
Eugene, Oregon 97401
(503) 485-2400

SUMMARY

Since its inception, decision analysis has made remarkable strides in developing a sophisticated and flexible methodology and in solving a variety of important problems. Much of this work has been conducted in the context of ARPA's Advanced Decision Technology program. Given this promising beginning and wealth of experience, the time seems ripe for decision analysis to give a hard look at which of its techniques and assumptions are the strongest and which need buttressing. The goal of such an investigation would be to elucidate what makes decision analysis and talented decision analysts most successful.

The vehicle for this discussion is an analogy drawn between decision analysis and the somewhat older profession of psychotherapy. Both offer a variety of techniques designed to help people function in a difficult and uncertain environment; both developed rapidly, sustained by a coherent underlying theory and anecdotal evidence of having helped some clients. Over the past half century, psychotherapy has faced a series of crises concerned with its transformation from an art to a clinical science. These include validation of the effectiveness of various forms of therapy, validating elements of treatment programs and assumptions of the underlying therapy, improving the clinical skills of individual practitioners, and considering the broader political, social, ideological and ethical issues raised by psychotherapy. It is hoped that by considering the issues which a related profession has identified, the approaches it has developed to study those issues, and the (partial) conclusions it has reached, we can speed the development of decision analysis.

Among the results of this investigation are:

(a) Well developed methodologies exist for evaluating the effectiveness of social interventions (of which both decision analysis and psychotherapy are examples), combined with pioneering evaluations like those of Brown and Watson at Decisions and Designs, Inc. (DDI). They could give leverage to determine where decision analysis is most cost effective.

(b) Substantial progress has been made in assessing the validity of some of the elicitation procedures used by decision analysts, however, relatively little is known about the robustness results particularly whether they apply in different contexts and with different judges. The judgmental side of some questions, like how decision problems are structured, has barely been studied.

(c) Much of the success of a decision analysis may depend upon the analyst's self-presentation, ability to get along with clients, a sensitivity to clients' unstated desires and uncertainties and capacity for instilling confidence. A manual of advice on how to fulfill these functions would be useful.

(d) Highly competent analyses can fail as guides to decisions if they adopt too narrow a definition of the decision problem. One must consider the political, organizational and legal constraints which may make a technically feasible course of action socially unfeasible. Ways are needed to incorporate into analyses the possibility that selected courses of action will not be adopted at all, or at least not as planned.

(e) Decision analysts might usefully consider following the example of psychotherapists in developing some sort of association that would monitor how analysts are trained and how analyses are performed, in order to protect the profession, clients, and the public from slipshod work.

TABLE OF CONTENTS

ACKNOWLEDGMENT

Partial support for this research was provided by the Advanced Research Projects Agency of the Department of Defense and was monitored by the Office of Naval Research under Contract N00014-76-C-0074 under subcontract from Decisions and Designs, Inc.

1. INTRODUCTION

Modern psychotherapy traces its roots back to the work of Freud and his contemporaries and to their insights into the etiology and treatment of mental disorders. A critical component of their revolutionary perspective was the realization that much inappropriate behavior should be attributed not to the (mis)behaver but to the world in which he or she lives. That world continually presents people with challenges, some of which cannot be met adequately, given people's cognitive, emotional and physical endowment. Although they vary from individual to individual and within individuals over time, these limitations are universal enough that some challenges would overwhelm everybody, meaning that failure to meet them is not a matter of personal ineptitude. Maladaptive responses make it more difficult to meet future challenges by committing the individual to ineffective behavior and to covering up what appear to be past mistakes. A common feature of most treatment plans is forcing people to face explicitly the most troublesome aspects of their life predicaments. To make this possible, it has been necessary to legitimatize talking about things (e.g., sex) previously excluded from proper discourse.

Over the years, psychotherapists have developed a number of theories with both descriptive and prescriptive content. These purport to show both how people live and how they might live better, given personal and situational limits. Although these theories give some order and direction to the complex business of understanding and helping people, therapy has always been seen as something of an art form whose success depends on the individual clinician's ability to pull the right technique out of a bag of tricks and to apply it appropriately.

From the beginning, therapists derived confidence in their craft from the coherence of their theory, their observation of clients who appeared to have been helped, clients' testimony that therapy had helped them and the obvious inadequacy of leaving clients to their own devices. Eventually, perhaps after their cumulative confidence passed some threshold, many came to feel that these sources of evidence were inadequate. For psychotherapy to become a scientific endeavor, it would have to submit to the evidential standards of science: empiricism, interobserver comparability, falsifiability and formal inference. Because serving these goals conflicts with the training and predisposition of many therapists and with the conduct of therapy, response has been quite varied. Some therapists view impressionistic case studies as the only path to knowledge; others structure every treatment as a research project. Purist practitioners of psychoanalysis and of behavior modification might be seen as representing the extremes of this continuum. The development of psychotherapy over the past fifty years has been a reflection of this conflict over its status as a science.

Decision analysis traces its roots to the observation that many problems would overwhelm even the most astute decision maker; that their complexity and enormity induce maladaptive responses and frequent failures; and that help is needed if people are to free themselves from inappropriate habits and make better decisions. Treatment is by an interactive relationship with a paid professional whose job it is to make explicit the complexities of the decision maker's situation. One obstacle to doing so is the need to legitimize talking about value conflicts and uncertainties often excluded

from public discourse. Although the decision analyst's techniques, like those of the psychotherapist, are developed from a theory with both normative and descriptive implications, they still constitute something of a bag of tricks, whose use requires the judicious application of clinical judgment. Like psychotherapy, decision analysis is advocated because the theory is persuasive, because many clients say that it helps them, because many practitioners are extremely talented, and because the alternative seems to be to sink back into an abyss (seat-of-the-pants decision making).

The great intellectual challenge facing decision analysis today is tackling the problem of becoming a science with which psychotherapists have been wrestling for the past half century. Is decision analysis to remain a craft with great intuitive appeal or will it subject itself to the tests of interobserver comparability, falsifiability, etc.? This is, of course, not a one-time decision, but a decision node at which the profession will find itself indefinitely. Although all analogies break down at some point, I will draw upon the experience of psychotherapy in the belief that it can be instructive to consider how a related field has formulated, grappled with and partially solved similar problems. Particularly because the progress of psychotherapy, or at least that caricature of psychotherapy presented here, has proved to be halting and indirect, examining the obstacles it has faced and its record in overcoming them may ease decision analysis' way through the same process.

One strategy in psychotherapy's scientific coming of age has been to attempt to validate whole theories or the effectiveness of entire treatment programs. A second has been

to divide and conquer, validating particular procedures or theoretical hypotheses. Differential effectiveness and cost effectiveness of various procedures have been major concerns. As even well-conceived treatments may fail if improperly implemented, a third focus has been on improving the clinical skills of individual therapists. A fourth concern has been to consider the broader context within which therapy is done: the socio-psycho-economic milieu within which both practitioner and client live and the philosophical-ethical basis of therapeutic theory and practice.

These topics are examined below both for decision analysis and for psychotherapy. Because they have been central to psychotherapy longer than to decision analysis, the presentation is often unbalanced. There is evidence on psychotherapy and conjecture about decision analysis. At times, these analogies and implications are pushed beyond available data in the interests of providing a little provocative speculation. Somewhat better documented observations on the practice of formal analysis are given by Fischhoff (in press).

2. EVALUATION

More than other social sciences, psychology draws its basic methodology from the natural sciences (primarily biology). When confronted by the question, "Does psychotherapy work?" (Eysenck, 1952), a natural response has been classic experimental studies. Clients are randomly assigned to groups, some receiving treatment, others placebos; differences between the groups are measured over time. Even in the best of circumstances, implementing this strategy is far from trivial; often it is impossible. For example, one may have no control over assignment to treatment groups, or have control and be ethically restrained from exercising it. For those situations, an extensive methodology of "quasi-experimental" designs has been developed (e.g., Campbell & Stanley, 1966; Riecken & Boruch, 1974), substituting innovative statistical controls for unattainable experimental control. At the extreme, time series analysis has been adopted for studying the effect of treatment on a single client (Jones, Vaught & Weinrott, in press).

The cumulative wisdom derived from evaluating psychotherapy and other social interventions points to a number of intricacies particularly relevant to evaluating decision analysis.

(a) The fact that practitioners have been trained in a method and claim to be carrying it out is no guarantee that they are (Loeber & Weismann, 1975). Assessing the fidelity of implementation is crucial for knowing what is being evaluated (Abt Associates, 1976; Kolata, 1977).

(b) Many people who apparently benefit from treatment would have improved anyway, due to changes in their life circumstances or outlook. For adults with neurotic disorders, the rate of "spontaneous remissions" has been estimated as between 0% and 90%, with a best guess of one half to two thirds (Lambert, 1976; Weinrott, 1977).

(c) The success of some treatments may be less due to their substantive, theory-based message and manipulations than to the atmosphere they create. Even with systematic desensitization for phobias, avowedly the most successful form of behavior modification, there is doubt that the effects are due to anything more than adroit staging (Kazdin & Wilcoxon, 1976). These "non-specific treatment effects" include suggestion, reduced apprehension, increased self-confidence and heightened attention to the problem (Atkinson & Carskadden, 1975).

(d) Unsubstantiated clinical judgments are not to be trusted. Even dispassionate clinicians of high integrity may see symptom-diagnosis correlations where there are none (Chapman & Chapman, 1967), treatment effects where statistical analysis shows random fluctuations (Jones, Weinrott & Vaught, 1975), a record of past success which is exaggerated (Fischhoff & Beyth, 1975; Langer & Roth, 1975) or proven treatment programs where there is but folklore and bandwagon effects (Schectman, 1977). A lesson here is always to keep systematic records in anticipation of the

day when someone will have the time, resources, and inclination to conduct a retrospective evaluation.

(e) Results can be biased by looking only for the positive effects a treatment produces and ignoring possible detrimental effects (Scriven, 1972) or looking only for the negative effects (Poulton, 1976). Casualty rates (adverse reactions) seem to run about 10% for conventional therapy (Bergin, 1971) and have been estimated from .2% to 47% for intensive encounter groups with the smallest rates reported by merchandisers of such treatments (Hartley, Roback & Abramowitz, 1976).

Inclusion of some evaluation methodology in psychotherapy training programs is no guarantee that graduates ever do any evaluation or do it right when they do attempt it. In articles reviewing research on the effectiveness of such diverse treatments as marathon encounter groups (Kilman & Sotile, 1976), sensitivity training (Smith, P., 1975), drug abuse reduction (Callner, 1975), behavioral marriage therapy (Jacobson & Martin, 1976) and behavior modification of juvenile deliquents (Davison & Seidman, 1974), one finds a similar litany of methodological criticisms: lack of a control group, inappropriate control groups, impressionistic statistical analysis, potentially biased data collectors, lack of follow-up observations, failure to check observer reliability, unrepresentative samples or inappropriate outcome measure(s). Not all studies are guilty of these infractions, but far too many are.

The fact that psychotherapy as a profession attempts to evaluate itself is certainly to its credit. Failure to develop an evaluation methodology would have suggested to many that it had something to hide. However, poor methodology map tip the balance unfairly against therapists interested in demonstrating the efficacy of treatments. Sloppy research tends to increase error variance and makes it hard to detect differences between treatment groups (Perloff, Perloff & Sussna, 1976).

Parallels with decision analysis seem natural. Some products labeled "decision analysis" really are not; and the craft should not be judged by their performance. It cannot be presumed that everyone who seems to have done well after decision analysis would have floundered without it; good habits, luck and situational pressures would have "spontaneously" produced some good decisions. Decision analysis may help a decision maker simply because the analyst's deskside manner helps the decision maker focus attention and resources on the problem, and not because of the specific techniques and axiomatic justification in their armamentarium. And so on.

Watson and Brown (1975a) have pioneered in developing a formal model with which to decision analyze decision analyses. This seems to be a promising direction if combined with the evaluative methodology produced by psychotherapists and others. Perhaps foretelling the difficulties awaiting such efforts, in two of the three case studies chosen by Watson and Brown (1975b) the greatest benefits of the analyses seemed to come not from the decisions they recommended, but from their contribution to

organizational processes (reduction of controversy and improvement of communication), considerations left out of Watson and Brown's formal model for the sake of simplicity.

It is, of course, reassuring to a clinician to hear clients say that the treatment helps them. However, as evidence, such claims are both insufficient and potentially obscurant. When we lack concrete proof of the efficacy of our wares, it is tempting to retreat to diverse, unmeasurable "touchy-feely" benefits. This, for example, has been the response of transcendental meditation advocates in the face of evidence that their method has no benefits beyond those of sitting still on a regular basis (Smith, J.C., 1975).

As mentioned, a persistent problem in evaluating treatments is guaranteeing that they have been implemented in accordance with their designers' intent (Kolata, 1977). It would not be fair to detract from decision analysis on the basis of crude, ineffectual analyses done by poorly trained individuals or under severe time restraints. Or would it? Most psychotherapists would agree that a treatment package must work "out in the world" or there is little point to it. If only a selected few can master the craft or if the masters do little to monitor those acting in the craft's name, then its role as a panacea is limited. Its role is also limited if the experience is so unpleasant or expensive that few clients ever get the full treatment. A program with a relatively high drop-out rate but great success with those who complete it will not be highly regarded, particularly when one considers that people who stay in treatment are those most susceptible to persuasive messages of any kind (according to attitude research; see Bandura, 1969).

Decision analysis is a tool designed for situations with scarcity and will almost always be used in such situations. All the resources (computer time, analyst fees, decision makers' attention) needed for a full, proper decision analysis will rarely be available. Indeed, analyses are always bounded for the sake of manageability. Thus in evaluating the field, one must ask, in effect, does decision analysis degrade gracefully? A little analysis is obviously not as good as a full-blown one, but will it be better than none at all? The answer may depend on what happens when adequate funds are denied. Does the analyst do somewhat less of everything, or are some aspects of the analysis eliminated entirely?

No clear overview of the current state of decision analysis now exists. Such an overview could be done by reviewing a random sample of recent reports of decision analysis and subjecting them to questions like the following:

Are the assumptions of the analysts listed?

Are the assumptions of the clients listed (e.g., those implicit in the way the problem was formulated)?

Are any of these assumptions tested, or is supporting evidence from other sources cited?

Are probabilities used? If so, is any justification given for the particular procedure by which they are elicited?

Are probabilities or utilities measured in more than one way?

Are values elicited from more than one person?

Are sensitivity analyses conducted, for probabilities, for utilities, with more than one factor varying at once?

Are interactions between impacts considered?

Is more than one problem structure used as a cross check?

Are possible alternatives given by the client or created with the client?

Are gaps in scientific knowledge noted?

Is a bottom line figure given and, if so, how is it hedged?

Is the public involved, and if so, at what stage?

Is there any consideration of political feasibility or legal constraints?

Is there any external criticism of the report, and if so, has the analysis been redone in its light?

Is there any indication of when the analysis should be redone to consider possible changes of circumstance and that such reanalyses will be done?

Is any attempt made to evaluate the analysis or to indicate how interested parties might do so on their own?

How much did the analysis cost?

If the reviewer has opinions about the quality of the analyses or the competence of the analysts, such judgments can be correlated with answers to the above questions to see what a good report is and what good analysts do (see Glaser & Taylor, 1973 for a related exercise performed on applied research projects).

3. DIVIDE AND CONQUER

Recognizing the difficulties of validating entire treatment programs and philosophies en masse, many therapists have focussed their research on the validity of the theoretical assumptions upon which treatment programs are based and the effectiveness of their component techniques. This strategy promises to be both feasible and instructive. Investigators typically believe that there is at least some truth to the therapy they are studying; what they want to know is what its strengths are and how can it be improved (Azrin, 1977).

Enormous amounts of effort have gone into validating theoretical assumptions such as: stable personality traits exist (Mischel, 1977); feedback facilitates learning (McKeachie, 1976); psychopathology is related to unconscious libidinal and aggressive wishes (Silverman, 1976); and self-awareness is necessary for improvement in therapy (Schectman, 1977).

An entire industry has emerged for the measurement and correlation of various personality and behavioral traits. Goldberg (1974) estimated that over 3000 books, chapters, and journal articles on "objective diagnostic tests and measures" appear yearly in English alone. The sophisticated methodology developed by personality measures merits reading by anyone measuring anything at least moderately squishy (Cronbach, Gleser, Nanda & Rajaratnam, 1972; Wiggins, 1973).

Perhaps because of a tendency for therapists to believe that their program is good for whatever ails one, there seems to have been limited response to calls to assess the

cost-effectiveness and differential effectiveness of various therapeutic devices (Tavormina, 1974). Several important research projects have, however, shown that the full regalia of treatment programs is not always essential to their effectiveness. The diagnostic role of trained clinicians can often be supplanted by simple computational formulae (Meehl, 1954), and the therapeutic role can be assumed by para-professionals trained in "helping skills" (Carkhuff, 1973; Danish, D'Augelli & Brock, 1976). Both types of replacement can substantially reduce the cost of treatment and increase the number of problems treated.

As might be expected, the divide-and-conquer strategy has appealed to students of decision analysis, if not necessarily to decision analysts. Slovic, Fischhoff and Lichtenstein (1977) reviewed a large number of studies which ask whether people accept the normative axioms upon which decision analysis is based and how well various elicitation procedures capture people's utilities and values. We now believe, with varying degrees of confidence, that people don't wish to accept Savage's independence axiom (Moskowitz, 1974; Slovic & Tversky, 1974); that they sometimes, but not often, want their judgments to be intransitive (Tversky, 1969); that there don't seem to be consistent individual differences in risk-proneness or aversiveness (Davidshofer, 1976; Wright & Phillips, 1976); and that verbally expressed preferences are not always consistent with those revealed in people's behavior (Fischhoff, Slovic, Lichtenstein, Read & Combs, 1976, and references therein). We still know little about questions like: Are value and utility judgments independent? Can we acceptably resolve inconsistencies in people's preferences

due to minor differences in presentation (Lichtenstein & Slovic, 1973; Kahneman & Tversky, 1977)? Will people reply honestly to our questions about their values and can we spot their lies or "strategic responses" (Brookshire, Ives & Schulze, 1976)? Is it possible for the decision analyst to act as a neutral agent when eliciting judgments? The subtle, unintentional ways in which one can influence another's behavior has been a persistent problem for would-be practitioners of non-directive, client-centered therapy (Rogers, 1951).

Regarding the validation of particular assessment techniques, we know quite a lot about probabilities (they tend to reflect overconfidence, although context makes a difference; see Lichtenstein, Fischhoff & Phillips, 1977; Fischhoff, Slovic & Lichtenstein, in press), less about utilities (see Kneppreth, Gustafson, Leifer & Johnson, 1974; Slovic, Lichtenstein & Fischhoff, 1977, pp. 20-4; and von Winterfeldt, 1975) and group aggregation of uncertainties and utilities (Seaver, 1976) and next to nothing about eliciting the structure of problems from decision makers. What this area really needs are more studies like Vertinsky and Wong (1975) and Fischer (1976), which compare different methods and use a variety of evaluative criteria, exploiting some of the sophisticated methodology designed for developers of psychological measures.

It also wouldn't hurt to study (if only to lay to rest) two threats to generality discovered by psychometricians. One is the fact that people's feelings about a particular object and the numbers they assign to those feelings can vary greatly with arbitrary features of the elicitation procedure,

like the order in which alternatives are presented, the heterogeneity of the set of alternatives, the contrast established between the first two alternatives, whether the scale is bounded and their preconceptions about how the numbers are supposed to be used (Poulton, 1968, 1977; Ross & DiLollo, 1971). The second threat is the fact, noted by Messick (1975), that it is not tests but responses which have validities and reliabilities. Thus, the adequacy of an elicitation procedure in one context with one particular set of individuals is not a guarantee of universal applicability.

Assuming that all this research gets done, we will still need both an error theory for decision analysis and a taxonomy of decision problems indicating which variant of decision analysis and its component techniques to use in each. The latter will tell us how to make the best of what we have and the former will tell us whether what we have is good enough.

As Fischer (1976) notes, without an error theory we cannot know to what extent violations of assumptions and lack of robustness in responses threaten the results of a decision analysis. Important steps toward developing such a theory (or theories) are:

(a) Fischer's (1976) work with multidimensional utility models,

(b) von Winterfeldt and Edwards' (1973) finding that with continuous decision options (e.g., invest X dollars) some inaccuracy in individual

probability and utility assessments will not produce terribly suboptimal decisions;

(c) Lichtenstein et. al.'s (1977) demonstration of how moderate miscalibration in probability assessment can substantially reduce expected utility with discrete decision options (e.g., operate/don't operate);

(d) von Winterfeldt and Edwards' (1975) identification of the ease with which dominated alternatives can be selected through improper modeling of a problem;

(e) Aschenbrenner and Kasubek's (in press) finding that two different, only partially overlapping, sets of attributes produced similar results in a multiattribute utility analysis;

(f) Kastenberg, McKone and Okrent's (1976) discovery of the extreme sensitivity of risk assessments to the (subjective) treatment of outliers; and

(g) Tihansky's (1976) finding that errors in different estimates were positively correlated and, therefore, would not tend to cancel one another out.

These are but pieces of an error theory. Particularly useful additions would be guidelines to the way in which uncertainty from varying sources (people not knowing what they want, people being affected by choice of questioning procedure, people being confused by instructions, random error, etc.)

is compounded. Until an adequate theory is developed, we will have to be very generous in performing sensitivity analyses for errors arising from judgmental sources.

Several recent guides to the selection of decision analytic procedures have been derived from formal properties of the decision situation (e.g., Emelyanov & Ozernoi, 1975; Keeney & Raiffa, 1976; Pearce, 1976). Additional efforts might look at more subjective aspects like the public visibility of the issue at hand, how well developed people's values are, how much freedom the analyst and decision maker have to construct alternatives, and whether any evaluation of the analysis is planned. Such a guide should tell us, among other things: When, in order to avoid misplaced precision, should all resources be invested in problem structuring and none in attaching numbers? Can high-priced analysts be replaced by para-professionals? When is it advisable to acknowledge the poorly developed nature of people's preferences and the limits of their information-processing abilities and to sacrifice axiomatic rigor for less demanding procedures (Edwards, 1976)? Psychological theories have been likened to box cameras which take pretty good pictures because they require subjects to be at a great distance, in the sun and immobile (Zuniga, 1975); is the same true of decision analysis?

4. CLINICAL SKILLS

However useful diagnostic tests and psychodynamic theories may be, therapists know that, in the last analysis, they, themselves, are their own major tool. Personally, they must instill confidence in clients, choose the appropriate questioning procedures to elicit sensitive information, handle crises, understand what is not being said, avoid imposing their own values and perceptions, and cooperate in creating solutions. To this end, clinical psychologists undergo 3-4 years of supervised practice, psychiatrists spend one to two years in internship (Kiesler, 1977), and psychoanalysts undergo psychoanalysis to be fully aware of how they see and interact with others.

Such training assumes that the finer points of the craft can only be learned in the clinic of a master; thus, many researchers are attempting to discover just what it is that makes masters (Goldman, 1976). It has been found, for example, that therapists' attitude is a crucial determinant of their success, particularly with low-income clients (Lorion, 1974), and that increasing clients' belief in the therapeutic approach and their confidence in the therapist can improve prognoses (Atkinson & Carskadden, 1975; Kazdin & Wilcoxon, 1975). It has long been known that one individual can shape another's responses with appreciative grunts and phrases (e.g., Howe & DiMattia, 1976). More recently, it has been found that nonverbal communication (posture, facial expressions, etc.) can account for up to 20 times as much variance in observers' behavior as verbal communication (Mehrabian, 1969). The therapist must understand these effects and how to use them to manipulate clients or how to avoid them, as appropriate.

Is the lot of the decision analyst that different? Internship, interviewing skills, instilling confidence . . . Can one not imagine an analyst subtly pressuring a client to change a probability assessment to a value the analyst believes is more acceptable, using verbal or nonverbal cues (analyst seems displeased; client thinks, "Well, you're the expert on probabilities. Maybe what I meant was . . ."). Such manipulation may not be apparent to either party; imagine an analyst and client "agreeing" that the latter's preferences on different attributes are really independent, making the elicitation procedure considerably less arduous. Slovic and Tversky (1974) showed how direct pressure may be used to induce clients to accept axiomatic principles. Further possibilities emerge when the analyst works with groups. For example, the fact that group discussions tend to polarize opinions (Myers & Lamm, 1975) suggests that the analyst can exert some control over the group's decision by deciding if and when the group should meet. Plott and Levine (1976) demonstrated the extent to which group decisions can be manipulated by varying the order in which issues are considered.

5. RESISTANCE

Resistance to therapy takes many forms, all threatening its success. The client may reject the approach because it is not expected to work (Holen & Kinsley, 1975), or because its procedures (e.g., talking openly about sensitive matters) are threatening, or because it is too expensive, or because of objections to its underlying philosophy of life (considered in the following section), or because the client is unwilling to admit that there is a problem. The client who accepts the approach may resist its recommendations because they require assuming too much responsibility for one's own life, or because it seems easier to remain somewhat ill than to adopt the required new behavior patterns, or because they mandate acknowledging one's own guilt, fallibility, desires or uncertainties. Psychoanalytic treatment is often deemed incomplete if such resistance is not encountered.

Even if the client is willing and able to adopt the therapeutic approach, treatment may fail because the reformed client leaves therapy for a hostile, unaccepting world. classic failures of this type have been encountered by the T-group or organizational development movement (Alderfer, 1977), which tries to improve communication in a work setting by involving some workers and managers in intensive group experiences stressing openness and sensitivity. All too often, however, the behavioral changes induced by the pressure of the group situation and the manipulation of the group leader vanish when group members return to their hierarchic work settings. Often (one might argue, always) it is not the client but the client's world which is "sick" and in need of help; the presenting problem is but an epiphenomenon.

Increasingly, therapists are realizing that treatment should extend to the client's family, work place and beyond, and that the most cost-effective treatment may be primary prevention aimed at improving the mental health of an entire community (Kelly, Snowden & Muñoz, 1977).

Important themes here are that the profession's goals include making therapy more cognizant of social realities and making society more cognizant of the need for therapy and its role in making therapy work.

People who need decision analysis may reject it because they are personally threatened by having to face and acknowledge their own doubts and desires, because they wish to avoid decision analysis' public disclosure requirement, because they feel uncomfortable and incompetent to deal with probabilities and multi-attribute certainty equivalents, because they are afraid to innovate, or because someone else (e.g., the public) pays most of the price for suboptimal decisions (Behn & Vaupel, 1976; Keeney & Raiffa, 1972).

Once a decision analysis has been performed, its bottom-line recommendations may be rejected because they are viewed as the output of numerical mumbo-jumbo which has no intuitive appeal and cannot be readily justified to superiors, subordinates, constituents, etc. Recommendations may also be resisted by people who feel that they have not been involved early enough and adequately enough in the analysis (Skolnikoff, 1977). They may even feel, like staunch believers in due process by law, that the decision-making process and the values it embodies and fosters are

more important than the decision produced. Giertz (1976) describes how residents of a flood plain developed a conservation program through a series of ad hoc procedures with extensive public participation and in doing so solved to mutual satisfaction equity issues which were irresolvable in theory. Even active participants may reject the conclusions of an analysis if they have irreconcilable differences with others involved. Consider, for example, Mellanby's (1972) insistence that biological criteria be the only ones used in cost-benefit analyses, or the insistence upon a noncompensatory decision model by many opponents of nuclear power or recombinant DNA research, for whom any chance of incurring the risks involved is unacceptable, whatever the benefits. Finally, a decision analysis may be resisted for purely political reasons. Any analysis done in the public domain will probably end up supporting one side in a dispute. To achieve its ends, the other side may fight hard and fight dirty, questioning every fact and assumption in the analysis and casting aspersions on the integrity of its analysts, however well the analysis is done and however much its conclusions are qualified (Barrager, Judd & North, 1976; Creighton, 1976). Analysts who believe in their work may face an uncomfortable choice between orphaning their proposals, letting their fate be decided by the vicissitudes of political struggle and public (mis)understanding, or adopting an advocacy role for the analysis and thereby for the recommended alternative.

Even if clients are willing to adopt and able to understand the analysts' recommendations, those recommendations may still be ignored or distorted when confronted by the real world. The hostile unaccepting reality faced by preferred alternatives includes legal, political, institutional, and human constraints.

Decision analysis is new, as are most of the problems to which it is applied and the very idea of analytic evaluation of societal endeavors. As a result, the legal statutes, regulations, precedents and interpretations relevant to decision analysis and the projects it considers are in a state of flux (Wichelman, 1976). Surprises, blockages and inefficiencies are to be expected. Westman (1977), for example, complains that the legal mandate given regulators in the United States entrusted with improving water quality precludes their adopting the most cost-effective methods. Often projects are held up so long and altered so extensively in legal and administrative proceedings that their accompanying analyses become antiquated. Performing reanalyses in such cases is, I believe, the exception rather than the rule.

Majone (1976) has argued persuasively that alternatives are almost never adopted as proposed, rather, they are subject to continuous negotiation and alteration by the parties concerned. Vogel and Nadel (1977) observe that consumer advocates in the United States direct much of their effort to exposés of the bureaucratic process in order to reveal collaboration between regulators and regulated industries and to pressure regulators in directions they, themselves, desire.

The diversity of pressures upon government officials may be so great that the only variable predicting whether analytic solutions will be adopted may be the presence or absence of at least one individual within government who is fanatic about their being used (Pack & Pack, 1977). Even "non-political" members of the public may prevent alternatives

from being adopted as advocated, by getting upset over errors and side-effects (even those which are inevitable and anticipatable, Einhorn, 1977), by misunderstanding the results of formal analyses (Lelouche, 1977) or by acting "irrationally" when rational behavior on their part is a key component of the adopted plan (e.g., failure of the U.S. National Flood Insurance Plan; Kunreuther, 1976).

What is to be done? An analyst is no more justified evaluating an alternative which is socially unfeasible than one which is technically impossible. Yet feasibility is both a relative and mutable thing. An analyst might append to each alternative a discussion of how it is likely to be waylaid en route to implementation and what needs to be done to keep it maximally intact. The analyst might also consider the ways in which each alternative might be distorted and the likelihood of each possible distortion occurring. Each act could then be treated as a set of possible events whose probabilities are entered into the analysis (Brown, 1975). The preferred alternative might turn out to be one with dominated consequences, but a better chance of being implemented.

In the long run, though, the adaptation should be mutual, with society and its most active citizens realizing their need to accommodate formal procedures. Toward this end, the educational potential of each analysis should be exploited. Public participation should be viewed as an opportunity, not a burden. According to Roessner (1976), it is more important to build the analytic capacity of different government units than to guarantee the adoption of particular, desirable alternatives.

6. IDEOLOGY AND ETHICS

Attempts to shape and direct others' lives cannot be value neutral. The therapist who is "only trying to help" has at the least made the evaluation that there is a situation needing help. The therapist who is "only trying to do what is best for the client" cannot avoid at least some subtle hints at what that "best" is. Even practitioners of client-centered therapies whose goal is to reflect and clarify their clients' own thoughts are still promulgating a world view, that people are responsible for their own predicaments and can extricate themselves if they only understand themselves sufficiently well. Baumgardner (1976) argues that the very search for lasting solutions to one's problems implies that the client's universe has more orderliness than may be the case.

The ideological biases of many therapeutic interventions are familiar intellectual topics: the mechanistic image of people projected by behaviorism and its potential for control (Stolz, Wienckowski & Brown, 1975), the ethnocentrism of psychoanalysis, the narcissism of many contemporary therapies (Marin, 1975; Lasch, 1976a), the general tendency to treat clients as objects rather than colleagues in therapy (Mischel, 1977), and the fatalism induced by approaches that induce people to accept their own life crises as inevitable (Lasch, 1976b).

Even when a therapy's philosophical basis is acceptable, it may be resisted because of ethical problems or political bias in the way it is used. Much opposition to behavior modification arose from its use in institutional settings

(prisons, asylums) in which free, informed consent to treatment by the patient is impossible. A frequent problem for practitioners is who is the true client, the patient or someone else (e.g., a hospital administrator) interested in maintaining order (Stolz et al, 1975). Other therapies have lost their credibility because therapists have become so dependent upon government and the politically powerful for their livelihood that they have lost the ability to make independent criticism (Snow & Newton, 1976), others because they can be afforded only by the rich, still others because they seem to be applied mainly to the poor (Lorion, 1974; Zuniga, 1975).

What image of people underlies decision analysis? At first blush, it seems to be a highly flattering one. With proper coaching, people are capable of understanding and expressing what they know and what they want. Acknowledging their information-processing limitations, they will allow these values and beliefs to be combined mechanically and then accept the indicated course of action.

There may, however, be problems with this seemingly innocuous perspective. One is that it may create an illusion of analyzability for problems that are unsolvable. Because decision analysis is oriented to picking the apparent best alternative rather than to assessing the adequacy of our knowledge, it may encourage us to act where ignorance dictates hesitation or continued information gathering. Because it asks us about everything important, it may lead us to believe that we have and should have beliefs and opinions about everything. We may be forced, for the sake of answering

the analyst, to create preferences which have little to do with our actual desires. Ellul (1969) has argued that forcing people to have (necessarily shallow) opinions about many things is the best way to guarantee that they have articulated views about nothing. Ignorance about our own beliefs may also have the effect of increasing the weight given to consequences bearing easily measured and justified monetary values.

The very reasonableness of decision analysis involves a political-ideological assumption, namely, that society is sufficiently cohesive and common-goaled that its problems can be resolved by reason and without struggle. Although this "get on with business" orientation will be pleasing to many, it will not satisfy all. For those who do not believe that society is in a fine-tuning stage, a technique which fails to mobilize public consciousness and involvement has little to recommend it.

Like therapy, if decision analysis is not biased at its core, it can be biased in its application. For example, most applications to societal problems seem to foster the transfer of decision-making power to a technical elite by offering little opportunity for effective citizen participation (Sewell & O'Riordan, 1976; Lovins, 1976). Although this trend seems inevitable due to the highly technical nature of the issues studied, in principle, it might be countered by hiring representative citizens to participate in the analytic process as consumer-advocate specialists in a particular issue. Such service might be considered a form of jury duty. Previous applications have also tended to ignore the issue of equitable distribution

of good and bad consequences. Although this is not a necessary feature of decision analysis, repeated omission of equity considerations and failure to develop the methodology needed to handle them will suggest lack of interest, or even evasiveness, on the part of analysts and those who hire them. If, as some have argued (Lekachman, 1976), most national economies are going into a stage of little overall growth, crucial questions for societal endeavors in the future will concern the distribution of existing wealth.

When analytic resources are limited, the analyst must take cues from someone about how to restrict the alternatives and consequences considered. That someone is likely to be the one who commissioned the study. If commissioners come consistently from one sector of society and consistently prefer (or reject out of hand) particular kinds of solutions or consequences, a persistent bias may be produced. Such bias would also include what issues are never analyzed and how results are presented. If the commissioners are public officials, there may be a strong predisposition toward reports that bury uncertainties and delicate assumptions either in sophisticated technical machinations or in masses of undigested data (Carter, 1975).

Psychotherapy's response to charges of ideological bias has been fairly minimal, with the most dramatic proposals within the profession being to encourage truth-in-packaging: providing potential clients with a description of the assumptions and procedures of an approach and perhaps even entering into a contractual agreement (Health Research Group, 1975; Schwitzgebel, 1975). Its response to charges of improprieties in the way in which therapy is conducted has

been more extreme. Clinical psychologists, for example, have organized as a guild with rigorous standards for entry, state and national licensing, censure mechanisms (albeit not often used), external review of research proposals and papers, and a strict code of ethics.

The most recent revision of the code of the American Psychological Association (adopted January 30, 1977, after nine years of work and 12 drafts) contains sections on:

(a) responsibility: openly discuss the limits of your knowledge; do not deliberately mislead clients; do not suppress disconfirming data;

(b) competence: recognize your own limitations;

(c) moral and legal standards: be aware of how the quality of your work reflects on your colleagues; avoid any action that will violate or diminish the legal or civil rights of clients or others;

(d) public statements: take full account of the limits and uncertainties of present psychological knowledge and techniques; your primary goal is to aid the public in forming their own informed judgments, opinions and choices;

(e) confidentiality;

(f) welfare of the consumer: fully inform consumers of the purpose and nature of evaluative treatment, educational, or training procedures, give them

freedom of choice with regard to participation, recognize your own needs and powerful position vis a vis clients; contribute a portion of your services to unpaid work;

(g) professional standards: when a colleague violates ethical standards, psychologists who know first hand of such activities should, if possible, attempt to rectify the situation; failing an informal solution, bring the matter to the attention of the appropriate local, state and/or national committee on professional ethics, standards, and practices;

(h) utilization of assessment techniques: you have the responsibility to provide explanations of the nature and purposes of the test results in language the client can understand; when a test is published, it should be accompanied by a manual fully describing its development rationale, evidence of validity and reliability, qualifications to and indications for use; and

(i) pursuit of research activities (American Psychological Association, 1977).

Whether a guild structure is needed or appropriate for decision analysis is not for me to say. Certainly, all that calls itself decision analysis does not glitter. However, the costs of policing incompetent analysts might be substantial, draining the efforts of qualified analysts, discrediting the profession by unrepresentative public quibbling, and raising

prices through restraint of trade. Perhaps more modest steps might be appropriate, if any are needed at all:

(a) setting up a formal "public interest decision analysis group" like that set up by the largest accounting firms in the United States in order to "give accounting away";

(b) insisting that some fixed amount of funds (say 10%) in all analysis contracts be allocated to independent external review;

(c) establishing a professional norm of participating in voluntary review networks (Smardon & Woodland, 1976-7);

(d) teaching students to conduct and document enough sensitivity analyses to satisfy a report's most skeptical critics (Chow, 1977); or

(e) adopting informal guidelines like those proposed by Fairley (1977) for experts called upon to assess probabilities of rare accidents.

Because it functions in the public domain, in addition to the private sector (commercial), decision analysis faces ethical dilemmas at least as challenging as those faced by psychotherapy. For example, the American Psychological Association's ethics committee was unable to agree on how to revise their standards regarding confidentiality (leaving them unchanged from 1964) even without having to consider (as the decision analyst might) the additional problems of

what to do with proprietary information or information that could cause public panic if released. Therapists may find themselves forced to treat a delinquent when they should be treating a family. Similarly, analysts may get well into a problem before realizing that the wrong problem has been attacked, or that the wrong information has been provided, or that they are being set up to produce an advocacy rather than an honest analysis. Therapists often face the problem of how to assure informed consent by psychologically incompetent clients (Schwitzgebel, 1975), whereas analysts are often asked to pursue their craft on behalf of clients, perhaps a whole society, judged technically incompetent.

7. CONCLUSION

The analyst's job is extremely difficult. Confronting the issues raised above (not all of which are new or unique to decision analysis) will make it even more difficult. Nonetheless, I believe that efforts to implement a research program exploring these problems would be well rewarded. Some of these issues have obvious pecuniary importance for the long-term prosperity of the field and its practitioners (e.g., proving its effectiveness and buttressing its foundations). Others, like examining ideological and ethical questions, will be highly stimulating intellectually. Still others, though, will seem like exercises in validating what common sense knows to be true (e.g., that there is more to decision analysis than putting on a good act). However, even study of these issues may have merit, for common sense may be wrong, may vary across individuals, and may be superficial. Examining the obvious can help convince others that we are right, improve our confidence in (and willingness to act upon) our knowledge, and help us learn why we were right all along.

8. REFERENCES

Abt Associates. Education As Experimentation: A Planned Variation Model. Vol. III. Boston, Ma.: Abt, 1976.

Alderfer, C.P. Organizational Development. Annual Review of Psychology, 1977, 28: 197-224.

American Psychological Association. Revised Ethical Standards For Psychologists. APA Monitor, 1977, 8(3): 22-23.

Aschenbrenner, K. M. and Kasubek, W. Convergence of Multi Multiattribute Evaluations When Different Sets of Attributes Are Used. In Jungerman, H. and deZeeuw, G. (Eds.) Decision Making and Change In Human Affairs. Amsterdam: D. Reidel, in press.

Atkinson, D.R. and Carskadden, G. A Prestigious Introduction, Psychological Jargon and Perceived Counselor Credibility. Journal of Counseling Psychology, 1975, 22: 180-186.

Azrin, N.H. A Strategy For Applied Research: Learning Based But Outcome Oriented. American Psychologist, 1977, 32: 140-149.

Bandura, A. Principles of Behavior Modification. New York: Holt, Rinehart & Winston, 1969.

Barrager, S.M., Judd, B.R. and North, D.W. Decision Analysis Of Energy Alternatives: A Comprehensive Framework For Decision Making. Palo Alto, Ca.: Stanford Research Institute, 1976.

Baumgardner, S.R. The Impact Of College Experiences On Conventional Career Logic. Journal of Counseling Psychology, 1976, 23: 40-45.

Behn, R.D. and Vaupel, J.W. Why Decision Analysis Is Rarely Used and How It Can Be. Duke University Center for Policy Analysis Working Paper, 1976.

Bergin, A.E. The Evaluation Of Therapeutic Outcomes. In Bergin, A.E. and Garfield, S.L. (Eds.) Handbook of Psychotherapy and Behavior Change. New York: Wiley, 1971.

Brookshire, D., Ives, B. and Schulze, W. The Valuation of Aesthetic Preferences. Journal of Environmental Economics and Management, 1976, 3.

Brown, R.V. Modeling Subsequent Acts For Decision Analysis. Decisions & Designs, Inc. (McLean, Va.) DDI Tech. Report 75-1, 1975.

Callner, D.A. Behavioral Treatment Approaches To Drug Abuse. Psychological Bulletin, 1975, 82: 143-164.

Campbell, D.T. and Stanley, J.C. Experimental and Quasi-Experimental Designs For Research In Teaching. In Gage, N.L. (Ed.) Handbook Of Research On Teaching. Chicago: Rand McNally, 1966.

Carkhuff, R.R. The Art of Helping. Amherst, Ma.: Human Resources Press, 1973.

Carter, L.J. Alaskan Gas: The Feds Umpire Another Confused Pipeline Debate. Science, 1975, 190: 362-364.

Chapman, L.J. and Chapman, J.P. Genesis of Popular But Erroneous Psychodiagnostic Observations. Journal of Abnormal Psychology, 1967, 72: 193-204.

Chow, B.G. The Economic Issues Of The Fast Breeder Reactor Program. Science, 1977, 195: 551-556.

Creighton, J.L. The Limitations and Constraints On Effective Citizen Participation. Address to the Interagency Council On Citizen Participation, Washington, D.C., December 8, 1976.

Cronbach, C.J., Gleser, G.C., Nanda, H. and Rajaratnam, N. The Dependability Of Behavioral Measurements: Theory of Generalizability For Scores and Profiles. New York: Wiley, 1972.

Danish, S.J., D'Augelli, A.R. and Brock, G.W. An Evaluation of Helping Skills Training. Journal of Counseling Psychology, 1976, 23: 259-266.

Davidshofer, L.O. Risk-Taking and Vocational Choice: A Reevaluation. Journal of Counseling Psychology, 1976, 23: 151-154.

Davison, W.S. and Seidman, E. Studies of Behavioral Modification and Juvenile Delinquency. Psychological Bulletin, 1974, 81: 998-1011.

Edwards, W. How To Use Multi-Attribute Utility Measurement For Social Decision Making. University of Southern California, 1976. SRI Report 76-3. Social Science Research Institute (Los Angeles, CA).

Einhorn, H.J. Decision Errors and Fallible Judgment Implications For Social Policy. Unpublished Manuscript, 1977.

Ellul, J. Propaganda. New York: Knopf, 1969.

Emelyanov, S.V. and Ozernoi, V.M. Decision Making In Multi-Objective Problems: A Survey. Problems of Control and Information Theory, 1975: 51-64.

Eysenck, H.J. The Effects of Psychotherapy: An Evaluation. Journal of Counseling Psychology, 1952, 16: 319-328.

Fairley, W.B. Evaluating the "Small" Probability of a Catastrophic Accident From the Marine Transportation of Liquefied Natural Gas. In Fairley, W.B. and Mosteller, F. (Eds.) Statistics and Public Policy. Reading, Ma.: Addison-Wesley, 1977.

Fischer, G.W. Multidimensional Utility Models For Risky and Riskless Choice. Organizational Behavior and Human Performance, 1976, 17: 127-146.

Fischhoff, B. Cost-Benefit Analysis and the Art of Motorcycle Maintenance. Policy Sciences, 1977; 8: 177-202.

Fischhoff, B. and Beyth, R. I Knew It Would Happen -- Remembered Probabilities of Once-Future Things. Organizational Behavior and Human Performance, 1975, 13: 1-16.

Fischhoff, B., Slovic, P. and Lichtenstein, S. Knowing With Certainty: The Appropriateness of Extreme Confidence. Journal of Experimental Psychology: Human Perception and Performance, in press.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S. and Combs, B. How Safe Is Safe Enough? A Psychometric Study of Attitudes Towards Technological Risks and Benefits. Decision Research, a Branch of Perceptronics, Report 76-1, 1976.

Giertz, J.F. An Experiment In Public Choice: The Miami Conservancy District, 1913-1922. Public Choice, 1976: 63-75.

Glaser, E.M. and Taylor, S.H. Factors Influencing the Success of Applied Research. American Psychologist, 1973, 28: 140-146.

Goldberg, L.R. Objective Diagnostic Tests and Measures. Annual Review of Psychology, 1974, 25: 343-366.

Goldman, L. A Revolution In Counseling Research. Journal of Counseling Psychology, 1976, 23: 543-552.

Hartley, D., Roback, H.B. and Abramowitz, S.I. Deterioration Effects In Encounter Groups. American Psychologist, 1976, 31: 247-255.

Health Research Group. Through The Mental Health Maze. Washington, D.C., 1975.

Holen, M.C. and Kinsley, W.M. Preference for Three Theoretically Derived Counseling Approaches. Journal of Counseling Psychology, 1975, 22: 21-23.

Howe, R.F. and DiMattia, D.J. Spatial Environments and Verbal Conditioning. Journal of Counseling Psychology, 1976, 23: 489-491.

Jacobson, N.S. and Martin, B. Behavioral Marriage Therapy: Current Status. Psychological Bulletin, 1976, 83: 540-556.

Jones, R.R., Vaught, R.S. and Weinrott, M. Time Series Analysis in Operant Research. Journal of Applied Behavior Analysis, in press.

Jones, R.R., Weinrott, M. and Vaught, R.S. Visual Versus Statistical Inference in Operant Research. In Kazdin, A. (Chair.) APA Symposium on the Use of Statistics in N=1 Research, Chicago, September 1975.

Kahneman, D. and Tversky, A. Prospect Theory: An Analysis of Decision Under Risk. Paper presented at the NSF Workshop on Risk Assessment and Evaluation, Eugene, Oregon, January 1977.

Kastenberg, W. E., McKone, T.E. and Okrent, D. On Risk Assessment In The Absence of Complete Data. UCLA Report No. UCLA-ENG-7677, July 1976.

Kazdin, A.E. and Wilcoxon, L.A. Systematic Desensitization and Non-Specific Treatment Effects. Psychological Bulletin, 1976, 83: 729-758.

Keeney, R. and Raiffa, H. A Critique of Formal Analysis in Public Decision Making. In Drake, A.W. Keeney, R.L. and Morse, P.M. (Eds.) Analysis of Public Systems. Cambridge, Ma.: MIT Press, 1972.

Keeney, R.L. and Raiffa, H. Decisions with Multiple Objectives. New York: Wiley, 1976.

Kelly, J.G., Snowden, L.R. and Muñoz, R.F. Social and Community Interventions. Annual Review of Psychology, 1977, 28:323-362.

Kiesler, C.A. The Training of Psychiatrists and Psychologists. American Psychologist, 1977, 32:107-108.

Kilman, P.R. and Sotile, W.M. The Marathon Encounter Group: A Review of the Outcome Literature. Psychological Bulletin, 1976, 83:837-850.

Kneppreth, N.P., Gustafson, D.H., Leifer, R.P. and Johnson, E.M. Techniques for the Assessment of Worth. U.S. Army Research Institute for the Behavioral and Social Sciences (Arlington, Va.) Technical Paper 254, 1974.

Kolata, G.B. Aftermath of the New Math: Its Originators Defend It. Science, 1977, 195:854-856.

Kunreuther, H. Limited Knowledge and Insurance Protection. Public Policy, 1976, 24:227-261.

Lambert, M.J. Spontaneous Remission in Adult Neurotic Disorders. Psychological Bulletin, 1976, 83:107-119.

Langer, E.J. and Roth, J. Heads I Win, Tails It's Chance: The Illusion of Control as a Function of the Sequence of Outcomes in a Purely Chance Task. Jounnal of Personality and Social Psychology, 1975, 32: 951-955.

Lasch, C. The Narcissistic Society. New York Review of Books, September 30, 1976a.

Lasch, C. Planned Obsolescence. New York Review of Books, October 28, 1976b.

Lekachman, R. Economists at Bay. New York: McGraw-Hill, 1976.

Lelouche, G. ATWS--Impact of a Non-Problem. Electric Power Research Institute Journal, 1977, (2):379.

Lichtenstein, S., Fischhoff, B. and Phillips, L.D. Calibration of Probabilities: The State of the Art. In Jungerman, H. and DeZeeuw, G. (Eds.) Decision Making and Change in Human Affairs. Amsterdam: D. Reidel, in press.

Lichtenstein, S. and Slovic, P. Response-Induced Reversals of Preference in Gambling: An Extended Replication in Las Vegas. Journal of Experimental Psychology, 1973, 101: 16-20

Loeber, R. and Weismann, R.G. Contingencies of Therapist and Trainer Behavior: A Review. Psychological Bulletin, 1975, 82: 660-688.

Lorion, R.P. Patient and Therapist Variables in the Treatment of Low-Income Patients. Psychological Bulletin, 1974, 81: 344-354.

Lovins, A.B. Comments in Barrager, S.M., Judd, B.R. and North, D.W., Decision Analysis of Energy Alternatives. Palo Alto, CA.: Stanford Research Institute, 1976.

Majone, G. Choice Among Policy Instruments for Pollution Control. Policy Analysis, 1976, 2:589-613.

Marin, P. The New Narcissism. Harpers, October 1975:45-56.

McKeachie, W.J. Psychology in America's Bicentennial Year. American Psychologist, 1976, 31:829-833.

Meehl, P.E. Clinical Versus Statistical Prediction. Minneapolis, Minn.: University of Minnesota Press, 1954.

Mehrabian, A. Significance of Posture and Position on the Communication of Attitude and Status Relations. Psychological Bulletin, 1969, 71:355-372.

Mellanby, K. The Biology of Pollution. London: Arnold, 1972.

Messick, S. The Standards Problem: Meanings and Values. Measurement and Evaluation, 1975, 31: 955-966.

Mischel, W. On the Future of Personality Measurement. American Psychologist, 1977, 32: 246-257.

Moskowitz, H. Effects of Problem Representation and Feedback on Rational Behavior in Allais and Morlat-Type Problems. Decision Sciences, 1974, 5: 225-242.

Myers, D.G. and Lamm, H. The Polarizing Effect of Group Discussions. American Scientist, 1975, 63:297-303.

Pack, H. and Pack, J.R. Urban Landscape Models: The Determination of Adoption and Use. Policy Science, 1977, 8: 79-101.

Pearce, D. The Limits of Cost-Benefit Analysis as a Guide To Environmental Policy. Kyklos, 1976, 29: 97-112.

Perloff, R., Perloff, E. and Sussna, E. Program Evaluation. Annual Review of Psychology, 1976, 27: 569-594.

Plott, C.R. and Levine, M.E. A Model of Agenda Influence on Committee Decisions. California Institute of Technology, (Pasadena, CA), Social Science Working Paper No. 146, 1976.

Poulton, E.C. The New Psychophysics: Six Models for Magnitude Estimation. Psychological Bulletin, 1968, 69:1-19.

Poulton, E.C. Quantitative Subjective Judgements Are Almost Always Biased, Sometimes Completely Misleading. Bulletin of the British Psychological Society, 1976, 29: 385-387.

Riecken, H.W. and Boruch, R.F. Social Experimentation: A Method For Planning and Evaluating Social Intervention. New York: Academic Press, 1974.

Roessner, J.D. Policy Issues and Policy Research in Public Technology. Policy Studies Journal, 1976, 5:211-216.

Rogers, C.R. Client-Centered Therapy. Boston: Houghton Mifflin, 1951.

Ross, J. and DiLollo, V. Judgment and Response in Magnitude Estimation. Psychological Bulletin, 1971, 78: 515-527.

Schectman, F. Convention and Contemporary Approaches to Psychotherapy. American Psychologist, 1977, 32: 197-204.

Schwitzgebel, R.K. A Contractual Model For The Protection of the Rights of Institutionalized Mental Patients. American Psychologist, 1975, 31: 815-820.

Scriven, M. Pros and Cons About Goal-Free Evaluation. Evaluation Comment, 1972, 3: 1-4.

Seaver, D.A. Assessment of Group Preferences and Group Uncertainty for Decision Making. University of Southern California, Social Science Research Institute (Los Angeles, CA) SSRI Report 76-4, 1976.

Sewell, W.R.D. and O'Riordan, T. The Culture of Participation in Environmental Decision Making. Natural Resources Journal, 1976, 16: 1-21.

Silverman, L.H. Psychoanalytic Theory: The Reports of My Death Are Greatly Exaggerated. American Psychologist, 1976, 31: 621-637.

Skolnikoff, E.B. Interactions Between Scientific Experts and Lay Public in Implementation of Nuclear Waste Management Goals. In Proceedings of a Conference on Public Policy Issues in Nuclear Waste Management, Chicago, October 27-29, 1976.

Slovic, P., Fischhoff, B. and Lichtenstein, S. Behavioral Decision Theory. Annual Review of Psychology, 1977, 28:1-39.

Slovic, P. and Tversky, A. Who Accepts Savage's Axiom? Behavioral Science, 1974, 19: 368-373.

Smardon, R. C. and Woodland, R.B. Some Preliminary Results of An Environmental Impact Report Review Process. Journal of Environmental Systems, 1976-77, 6: 209-228.

Smith, J.C. Meditation as Psychotherapy: A Review of Literature. Psychological Bulletin, 1975, 82: 558-569.

Smith, P.B. Controlled Studies of the Outcome of Sensitivity Training. Psychological Bulletin, 1975, 82: 594-662.

Snow, D.L. and Newton, P.M. Task, Social Structure and Social Process in the Community Mental Health Movement. American Psychologist, 1976, 31: 582-594.

Stolz, S.B., Wienckowski, L.A. and Brown, B.S. Behavior Modification. American Psychologist, 1975, 30: 1027-1048.

Tavormina, J.B. Basic Models of Parent Counseling. Psychological Bulletin, 1974, 81: 827-835.

Tihansky, D. Confidence Assessment of Military Air Frame Cost Predictions. Operations Research, 1976, 24: 26-43.

Tversky, A. Intransitivity of Preferences. Psychological Review, 1969, 76: 31-48.

Vertinsky, I. and Wong, E. Eliciting Preferences and The Construction of Indifference Maps: A Comparative Empirical Evaluation of Two Measurement Methodologies. Socio-Economic Planning Sciences, 1975, 9: 15-24.

Vogel, D. and Nadel, M. Who is a Consumer? An Analysis of The Politics of Consumer Conflict. American Politics Quarterly, 1977, 5: 27-56.

Watson, S.R. and Brown, R.V. Issues in the Value of Decision Analysis. Decisions & Designs (McLean, VA.) DDI Technical Report 75-9, 1975a.

Watson, S.R. and Brown, R.V. Issues in the Value of Decision Analysis. Decisions & Designs (McLean, VA.) DDI Technical Report 75-10, 1975b.

Weinrott, M. Personal Communication, May 4, 1977.

Westman, W.E. Problems in Implementing U.S. Water Quality Goals. American Scientist, 1977, 65: 197-203.

Wichelman, A.F. Administrative Agency Implementation of the NEPA of 1969: A Conceptual Framework For Explaining Differential Response. Natural Resources Journal, 1976, 16: 263-300.

Wiggins, J.W. Personality and Prediction: Principles of Personality Assessment. Reading, MA.: Addison Wesley, 1973.

von Winterfeldt, D. An Overview, Integration, and Evaluation of Utility Theory for Decision Analysis. University of Southern California, Social Science Research Institute (Los Angeles, CA). SSRI Research Report 75-9, 1975.

von Winterfeldt, D. and Edwards, W. Evaluation of Complex Stimuli Using Multi-Attribute Utility Procedures. University of Michigan, Engineering Psychology Laboratory (Ann Arbor, Michigan) Technical Report 011313-2-T, 1973.

von Winterfeldt, D. and Edwards, W. Error in Decision Analysis: How to Create the Possibility of Large Losses by Using Dominated Strategies. University of Southern California, Social Science Research Institute (Los Angeles, CA). SSRI Research Report 75-4, 1975.

Wright, G.N. and Phillips, L.D. Personality and Probabilistic Thinking in Assessing Probabilities for Discrete Events. Brunel Institute of Organization and Social Studies. Technical Report 76-3, 1976.

Zuniga, R.B. The Experimenting Society and Radical Social Reform. American Psychology, 1975, 30: 99-115.

CONTRACT DISTRIBUTION LIST
(Unclassified Technical Reports)

Director Advanced Research Projects Agency Attention: Program Management Office 1400 Wilson Boulevard Arlington, Virginia 22209	2 copies
Office of Naval Research Attention: Code 455 800 North Quincy Street Arlington, Virginia 22217	3 copies
Defense Documentation Center Attention: DDC-TC Cameron Station Alexandria, Virginia 22314	12 copies
DCASMA Baltimore Office Attention: Mr. K. Gerasim 300 East Joppa Road Towson, Maryland 21204	1 copy
Director Naval Research Laboratory Attention: Code 2627 Washington, D.C. 20375	6 copies
Office of Naval Research Attention: Code 102IP 800 North Quincy Street Arlington, Virginia 22217	6 copies

Revised August 1977

SUPPLEMENTAL DISTRIBUTION LIST
(Unclassified Technical Reports)

Department of Defense

Director of Net Assessment
Office of the Secretary of Defense
Attention: MAJ Robert G. Gough, USAF
The Pentagon, Room 3A930
Washington, DC 20301

Assistant Director (Net Technical Assessment)
Office of the Deputy Director of Defense Research and Engineering (Test and Evaluation)
The Pentagon, Room 3C125
Washington, DC 20301

Assistant Director (Environmental and Life Sciences)
Office of the Deputy Director of Defense Research and Engineering (Research and Advanced Technology)
Attention: COL Henry L. Taylor
The Pentagon, Room 3D129
Washington, DC 20301

Director, Defense Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, VA 22209

Director, Cybernetics Technology Office
Defense Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, VA 22209

Director, ARPA Regional Office (Europe)
Headquarters, U.S. European Command
APO New York 09128

Director, ARPA Regional Office (Pacific)
Staff CINCPAC, Box 13
APO San Francisco 96610

Dr. Don Hirta
Defense Systems Management School
Building 202
Ft. Belvoir, VA 22060

Chairman, Department of Curriculum Development
National War College
Ft. McNair, 4th and P Streets, SW
Washington, DC 20319

Defense Intelligence School
Attention: Professor Douglas E. Hunter
Washington, DC 20374

Command and Control Technical Center
Defense Communications Agency
Attention: Mr. John D. Hwang
Washington, DC 20301

Department of the Navy

Office of the Chief of Naval Operations (OP-987)
Attention: Dr. Robert G. Smith
Washington, DC 20350

Office of the Chief of Naval Operations (OP-951)
Washington, DC 20450

Office of Naval Research
Assistant Chief for Technology (Code 200)
800 N. Quincy Street
Arlington, VA 22217

Office of Naval Research (Code 230)
800 North Quincy Street
Arlington, VA 22217

Office of Naval Research
Naval Analysis Programs (Code 431)
800 North Quincy Street
Arlington, VA 22217

Office of Naval Research
Operations Research Programs (Code 434)
800 North Quincy Street
Arlington, VA 22217

Office of Naval Research (Code 436)
Attention: Dr. Bruce MacDonald
800 North Quincy Street
Arlington, VA 22217

Office of Naval Research
Information Systems Program (Code 437)
800 North Quincy Street
Arlington, VA 22217

Director, ONR Branch Office
Attention: Dr. Charles Davis
536 South Clark Street
Chicago, IL 60605

Director, ONR Branch Office
Attention: Dr. J. Lester
495 Summer Street
Boston, MA 02210

Director, ONR Branch Office
Attention: Dr. E. Gloye
1030 East Green Street
Pasadena, CA 91106

Director, ONR Branch Office
Attention: Mr. R. Lawson
1030 East Green Street
Pasadena, CA 91106

Office of Naval Research
Scientific Liaison Group
Attention: Dr. M. Bertin
American Embassy - Room A-407
APO San Francisco 96503

Dr. A. L. Slafkosky
Scientific Advisor
Commandant of the Marine Corps (Code RD-1)
Washington, DC 20380

Headquarters, Naval Material Command
(Code 0331)
Attention: Dr. Heber G. Moore
Washington, DC 20360

Head, Human Factors Division
Naval Electronics Laboratory Center
Attention: Mr. Richard Coburn
San Diego, CA 92152

Dean of Research Administration
Naval Postgraduate School
Attention: Patrick C. Parker
Monterey, CA 93940

Naval Personnel Research and Development
Center
Acquisition and Initial Service (Code 310)
Attention: Dr. Leonard P. Kroeker
San Diego, CA 92152

Naval Personnel Research and Development
Center (Code 305)
Attention: LCDR O'Bar
San Diego, CA 92152

Navy Personnel Research and Development
Center
Manned Systems Design (Code 311)
Attention: Dr. Fred Muckler
San Diego, CA 92152

Naval Training Equipment Center
Human Factors Department (Code N215)
Orlando, FL 32813

Naval Training Equipment Center
Training Analysis and Evaluation Group
(Code N-00T)
Attention: Dr. Alfred F. Smode
Orlando, FL 32813

Director, Center for Advanced Research
Naval War College
Attention: Professor C. Lewis
Newport, RI 02840

Naval Research Laboratory
Communications Sciences Division (Code 5403)
Attention: Dr. John Shore
Washington, DC 20375

Dean of the Academic Departments
U.S. Naval Academy
Annapolis, MD 21402

Chief, Intelligence Division
Marine Corps Development Center
Quantico, VA 22134

Department of the Army

Deputy Under Secretary of the Army
(Operations Research)
The Pentagon, Room 2E621
Washington, DC 20310

Director, Army Library
Army Studies (ASDIRS)
The Pentagon, Room 1A534
Washington, DC 20310

U.S. Army Research Institute
Organizations and Systems Research Laboratory
Attention: Dr. Edgar M. Johnson (PERI-OK)
1300 Wilson Boulevard
Arlington, VA 22209

Director, Organizations and Systems
Research Laboratory
U.S. Army Institute for the Behavioral
and Social Sciences
1300 Wilson Boulevard
Arlington, VA 22209

Technical Director, U.S. Army Concepts
Analysis Agency
8120 Woodmont Avenue
Bethesda, MD 20014

Director, Strategic Studies Institute
U.S. Army Combat Developments Command
Carlisle Barracks, PA 17013

Commandant, Army Logistics Management Center
Attention: DRXMC-LS-SCAD (ORSA)
Ft. Lee, VA 23801

Department of Engineering
United States Military Academy
Attention: COL A. F. Grum
West Point, NY 10996

Chief, Studies and Analysis Office
Headquarters, Army Training and Doctrine
Command
Ft. Monroe, VA 23351

Commander, U.S. Army Research Office (Durham)
Box CM, Duke Station
Durham, NC 27706

Department of the Air Force

Assistant for Requirements Development
and Acquisition Programs
Office of the Deputy Chief of Staff for
Research and Development
The Pentagon, Room 4C331
Washington, DC 20330

Air Force Office of Scientific Research
Life Sciences Directorate
Building 410, Bolling AFB
Washington, DC 20332

Commandant, Air University
Maxwell AFB, AL 36112

Chief, Systems Effectiveness Branch
Human Engineering Division
Attention: Dr. Donald A. Topmiller
Wright-Patterson AFB, OH 45433

Director, Advanced Systems Division
(AFHRL/AS)
Attention: Dr. Gordon Eckstrand
Wright-Patterson AFB, OH 45433

Commander, Rome Air Development Center
Attention: Mr. John Atkinson
Griffis AFB
Rome, NY 13440

IRD, Rome Air Development Center
Attention: Mr. Frederic A. Dion
Griffis AFB
Rome, NY 13440

HQS Tactical Air Command
Attention: LTCOL David Dianich
Langley AFB, VA 23665

Other Government Agencies

Chief, Strategic Evaluation Center
Central Intelligence Agency
Headquarters, Room 2G24
Washington, DC 20505

Director, Center for the Study of Intelligence
Central Intelligence Agency
Attention: Mr. Dean Moor
Washington, DC 20505

Office of Life Sciences
Headquarters, National Aeronautics and Space Administration
Attention: Dr. Stanley Deutsch
600 Independence Avenue
Washington, DC 20546

Other Institutions

Department of Psychology
The Johns Hopkins University
Attention: Dr. Alphonse Chapanis
Charles and 34th Streets
Baltimore, MD 21218

Institute for Defense Analyses
Attention: Dr. Jesse Orlansky
400 Army Navy Drive
Arlington, VA 22202

Director, Social Science Research Institute
University of Southern California
Attention: Dr. Ward Edwards
Los Angeles, CA 90007

Perceptronics, Incorporated
Attention: Dr. Amos Freedy
6271 Variel Avenue
Woodland Hills, CA 91364

Stanford University
Attention: Dr. R. A. Howard
Stanford, CA 94305

Department of Psychology
Montgomery College
Attention: Dr. Victor Fields
Rockville, MD 20850

Director, Applied Psychology Unit
Medical Research Council
Attention: Dr. A. D. Baddeley
15 Chaucer Road
Cambridge, CB 2EF
England

Decision Analysis Group
Stanford Research Institute
Attention: Dr. Miley W. Merkhofer
Menlo Park, CA 94025

Human Factors Research, Incorporated
Santa Barbara Research Park
Attention: Dr. Robert R. Mackie
6780 Cortona Drive
Goleta, CA 93017

Wharton School
University of Pennsylvania
Attention: Dr. H. L. Morton
Philadelphia, PA 19174

Decision Research
1201 Oak Street
Eugene, OR 97401

Department of Psychology
University of Washington
Attention: Dr. Lee Roy Beach
Seattle, WA 98195

Analytics, Incorporated
Attention: Mr. William Martin
7405 Colshire Drive, Suite 200
McLean, VA 22101

Eclectech Associates, Incorporated
Attention: Mr. Alan J. Pesch
Post Office Box 179
North Stonington, CT 06359

Department of Electrical and Computer Engineering
University of Michigan
Attention: Professor Kan Chen
Ann Arbor, MI 94135

Department of Government and Politics
University of Maryland
Attention: Dr. Davis B. Bobrow
College Park, MD 20747

CACI, Incorporated-Federal
Attention: Dr. Bertram Spector
1815 North Fort Myer Drive
Arlington, VA 22209

Department of Psychology
Hebrew University
Attention: Dr. Amos Tversky
Jerusalem, Israel

Dr. T. Owen Jacobs
P.O. Box 3122
Ft. Leavenworth, KA 66027

Dr. Gary Ireland
500 23rd Street, NW - Apt. B301
Washington, DC 20037

Dr. Andrew P. Sage
School of Engineering and Applied Science
University of Virginia
Charlottesville, VA 22901

Professor Raymond Tantor
Political Science Department
The University of Michigan
Ann Arbor, MI 48109

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ~~PTR-1042-77-5~~	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* (6) DECISION ANALYSIS & CLINICAL ART OR CLINICAL SCIENCE?		5. TYPE OF REPORT & PERIOD COVERED (9) Technical Report,
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) Baruch Fischhoff	(15)	8. CONTRACT OR GRANT NUMBER(s) N00014-76-C-0074
9. PERFORMING ORGANIZATION NAME AND ADDRESS Decision Research Decisions and Designs ~~A Branch of~~ Perceptronics 1201 Oak Street, Eugene, Oregon 97401		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS ARPA Order ~~No.~~ 3052
11. CONTROLLING OFFICE NAME AND ADDRESS (11)		12. REPORT DATE May 77
		13. NUMBER OF PAGES 57 (12) 58p.
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* Office of Naval Research, Code 455 800 N. Quincy Street Arlington, Virginia 22217		15. SECURITY CLASS. *(of this Report)* Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

NONE

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Decision analysis
Evaluating decisions
Psychotherapy
Probability assessment
utility
ethics
Training decision makers

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

An analogy is drawn between decision analysis and the somewhat older profession of psychotherapy. Both offer a variety of techniques designed to help people function in a difficult and uncertain environment; both developed rapidly, sustained by a coherent underlying theory and anecdotal evidence of having helped some clients. Over the past half century, psychotherapy has faced a series of crises concerned with its transformation from an art to a clinical science. These include validation of

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified 390 664

20. (Continued)

the effectiveness of various forms of therapy, validating elements of treatment programs and assumptions of the underlying therapy, improving the clinical skills of individual practitioners, and considering the broader political, social, ideological and ethical issues raised by psychotherapy. It is hoped that by considering the issues which a related profession has identified, the approaches it has developed to study those issues, and the (partial) conclusions it has reached, we can speed the development of decision analysis.